

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C. 20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 17 October 2000 (17.10.00)	
International application No. PCT/GB00/00312	Applicant's or agent's file reference PJA/C088335PWO
International filing date (day/month/year) 04 February 2000 (04.02.00)	Priority date (day/month/year) 05 February 1999 (05.02.99)
Applicant FAWCETT, Michael, J. et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

23 August 2000 (23.08.00)

☐ in a notice effecting later election filed with the International Bureau on:2. The election ☒ was☐ was not

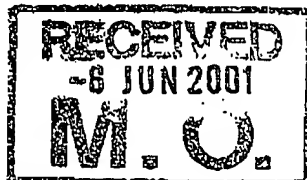
made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Juan Cruz Telephone No.: (41-22) 338.83.38
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From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

Allman, Peter John
MARKS & CLERK
Sussex House
83-85 Mosley Street
Manchester M2 3LG
GRANDE BRETAGNE



PCT

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL PRELIMINARY
EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing
(day/month/year)

30.05.2001

Applicant's or agent's file reference

PJA/C088335PWO

IMPORTANT NOTIFICATION

International application No.

PCT/GB00/00312

International filing date (day/month/year)

04/02/2000

Priority date (day/month/year)

05/02/1999

Applicant

ROTA ENGINEERING LIMITED et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/



European Patent Office - P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk - Pays Bas
Tel. +31 70 340 - 2040 Tx: 31 651 epo nl
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Authorized officer

Dekker, M

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference PJA/C088335PWO		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB00/00312	International filing date (day/month/year) 04/02/2000	Priority date (day/month/year) 05/02/1999	
International Patent Classification (IPC) or national classification and IPC H01R13/703			
Applicant ROTA ENGINEERING LIMITED et al.			



1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 4 sheets.

3. This report contains Indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand 23/08/2000	Date of completion of this report 30.05.2001
Name and mailing address of the International preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized officer Waern, G  Telephone No. +31 70 340 2529

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/00312

I. Basis of the report

1. With regard to the elements of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

1,3-9 as originally filed

2,2a as received on 15/02/2001 with letter of 08/02/2001

Claims, No.:

1-10 as received on 15/02/2001 with letter of 08/02/2001

Drawings, sheets:

1/9-9/9 as originally filed

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**International application No. **PCT/GB00/00312**

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims 1-10
	No: Claims
Inventive step (IS)	Yes: Claims 1-10
	No: Claims
Industrial applicability (IA)	Yes: Claims 1-10
	No: Claims

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet



INTERNATIONAL PRELIMINARY

International application No. PCT/GB00/00312

EXAMINATION REPORT - SEPARATE SHEET

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

NOVELTY

The connector according to claim 1 differs from the closest prior art represented by US-A- 3644 871 in that means are being provided for locking the or each contact holder to the contact of the other connector element unless the first and second contacts are separated.

Thus the application satisfies the criterion set forth in Article 33(2) PCT because the subject matter of claim 1 is new in the light of the prior art as defined in the regulations (Rule 64(1)-(3)PCT).

INVENTIVE STEP

The invention relates to an isolating connector for interconnecting or mutually isolating two or more circuits.

The aim of the invention is to provide an electrical connector that can be used safely in applications where the connectors may be exposed to explosive atmospheres.

The claimed connector proposes an arrangement where means are provided to lock the or each displaceable contact holder, carrying the interconnected second and third contacts, to the contact of the other connector element unless the first and second contacts are separated. By being locked to the contacts of the other connector element, the locked together contact holders thus at a certain moment of the mating and

INTERNATIONAL PRELIMINARY

International application No. PCT/GB00/00312

EXAMINATION REPORT - SEPARATE SHEET

unmating of the connector elements create a closed chamber where the first and second contacts are located electrically isolated from the environment, thus the required safety is achieved.

None of the cited documents alone or in combination discloses or suggests a connector having displaceable contact holders that can be locked to the contacts of the other connecting element to achieve an electric isolation between mating contacts, and the subject matter of claim 1 therefore involves an inventive step (Rule 65(1)(2)PCT) and the application meets the criterion set forth in Article 33(3)PCT.

The dependent claims 2-10 define further embodiments of the connector according to claim 1, and the criterion of Article 33(3)PCT is met also with respect to the dependent claims.

INTERNATIONAL PRELIMINARY

International application No. PCT/GB00/00312

EXAMINATION REPORT - SEPARATE SHEET

Re Item VII**Certain defects in the international application**

1. The independent claim is not drafted in the preferred two part form correctly delimited from the prior art (Rule 6.3(b) PCT).
2. The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).
3. A reference to a document disclosing the prior art as discussed on page 1 should have been introduced into the description, (Rule 5.1(a)(ii) PCT).

Re Item VIII**Certain observations on the international application**

1. According to Rule 6.2(a) PCT claims shall not, except where absolutely necessary, rely on references to description or drawings. Claim 11 however merely refers to the drawings, thus the claim is not drafted in accordance with said rule.

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/GB 00/00312

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H01R13/703 H01R13/533 H01R13/627

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 644 871 A (S.A. FRANCELO) 22 February 1972 (1972-02-22) column 1, line 67 -column 4, line 6; figures 1,3	1,3-10
A	DE 39 30 210 A (SOURIAU) 21 March 1991 (1991-03-21) column 4, line 31 -column 5, line 44; figure 1	1-11

☐ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents:

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document but published on or after the international filing date

L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

Z document member of the same patent family

Date of the actual completion of the international search

4 May 2000

Date of mailing of the international search report

15/05/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax (+31-70) 340-3016

Authorized officer

Waern, G

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/00312

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 3644871	A	22-02-1972	NONE	
DE 3930210	A	21-03-1991	FR 2651928 A	15-03-1991
			GB 2236915 A	17-04-1991
			IT 1243009 B	23-05-1994

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference PJA/C088335PWO	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/GB 00/ 00312	International filing date (day/month/year) 04/02/2000	(Earliest) Priority Date (day/month/year) 05/02/1999
Applicant ROTA ENGINEERING LIMITED et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of Invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☐ the text is approved as submitted by the applicant.

☒ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☒ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

2
☐ None of the figures.

B x III TEXT OF THE ABSTRACT (Continuation of Item 5 of the first sheet)

A connector for interconnecting or mutually isolating two circuits one of which is connected to a first connector element (1) and the other of which is connected to a second connector element (2) which is interengageable with the first. One of the connector elements supports a first contact (12) connected to a respective circuit and a displaceable contact holder (4) carrying interconnected second (14) and third (15) contacts. The contact holder is displaceable between a first position in which the first (12) and second (14) contacts are separated and a second position in which the first and second contacts are interconnected. The connector elements are formed such that on interengagement the contact holder is displaced from the first to the second position after the third contact is interconnected with a contact (34) of the other connector element (2). The arrangement is such that on disengagement of the connector elements (1,2) the contact holder is displaced from the second to the first position. The contacts are arranged such that on disengagement the first and second contacts separate before the third contact is separated from the other connector element and such that when separated the first and second contacts are located within a closed chamber defined within the connector element in which the contact holder is supported.

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01R13/703 H01R13/533 H01R13/627

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 644 871 A (S.A. FRANCELO) 22 February 1972 (1972-02-22) column 1, line 67 -column 4, line 6; figures 1,3	1,3-10
A	DE 39 30 210 A (SOURIAU) 21 March 1991 (1991-03-21) column 4, line 31 -column 5, line 44; figure 1	1-11

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

4 May 2000

Date of mailing of the international search report

15/05/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Waern, G

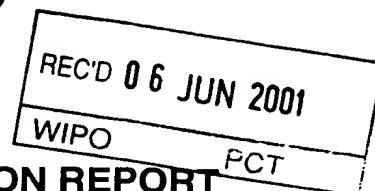
Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3644871 A	22-02-1972	NONE	
DE 3930210 A	21-03-1991	FR 2651928 A GB 2236915 A IT 1243009 B	15-03-1991 17-04-1991 23-05-1994

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)



Applicant's or agent's file reference PJA/C088335PWO	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB00/00312	International filing date (day/month/year) 04/02/2000	Priority date (day/month/year) 05/02/1999
International Patent Classification (IPC) or national classification and IPC H01R13/703		
Applicant ROTA ENGINEERING LIMITED et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 6 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 4 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand 23/08/2000	Date of completion of this report 30.05.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized officer Waern, G Telephone No. +31 70 340 2529 



INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/00312

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, pages:

1,3-9	as originally filed			
2,2a	as received on	15/02/2001	with letter of	08/02/2001

Claims, No.:

1-10	as received on	15/02/2001	with letter of	08/02/2001
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Drawings, sheets:

1/9-9/9	as originally filed
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2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/00312

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-10
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-10
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-10
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

7

Re Item V

**Reasoned statement under Article 35(2) with regard to novelty,
inventive step or industrial applicability; citations and explanations
supporting such statement**

NOVELTY

The connector according to claim 1 differs from the closest prior art represented by US-A- 3644 871 in that means are being provided for locking the or each contact holder to the contact of the other connector element unless the first and second contacts are separated.

Thus the application satisfies the criterion set forth in Article 33(2) PCT because the subject matter of claim 1 is new in the light of the prior art as defined in the regulations (Rule 64(1)-(3)PCT).

INVENTIVE STEP

The invention relates to an isolating connector for interconnecting or mutually isolating two or more circuits.

The aim of the invention is to provide an electrical connector that can be used safely in applications where the connectors may be exposed to explosive atmospheres.

The claimed connector proposes an arrangement where means are provided to lock the or each displaceable contact holder, carrying the interconnected second and third contacts, to the contact of the other connector element unless the first and second contacts are separated. By being locked to the contacts of the other connector element, the locked together contact holders thus at a certain moment of the mating and

unmating of the connector elements create a closed chamber where the first and second contacts are located electrically isolated from the environment, thus the required safety is achieved.

None of the cited documents alone or in combination discloses or suggests a connector having displaceable contact holders that can be locked to the contacts of the other connecting element to achieve an electric isolation between mating contacts, and the subject matter of claim 1 therefore involves an inventive step (Rule 65(1)(2)PCT) and the application meets the criterion set forth in Article 33(3)PCT.

The dependent claims 2-10 define further embodiments of the connector according to claim 1, and the criterion of Article 33(3)PCT is met also with respect to the dependent claims.

Re Item VII

Certain defects in the international application

1. The independent claim is not drafted in the preferred two part form correctly delimited from the prior art (Rule 6.3(b) PCT).
2. The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).
3. A reference to a document disclosing the prior art as discussed on page 1 should have been introduced into the description, (Rule 5.1(a)(ii) PCT).

Re Item VIII

Certain observations on the international application

1. According to Rule 6.2(a) PCT claims shall not, except where absolutely necessary, rely on references to description or drawings. Claim 11 however merely refers to the drawings, thus the claim is not drafted in accordance with said rule.

respective circuit and at least one of which supports a first contact connected to the respective circuit and a displaceable contact holder carrying interconnected second and third contacts, the contact holder being displaceable between a first position in which the first and second contacts are separated and a second position in which the first and second contacts are interconnected, wherein the connector elements are formed such that on interengagement the contact holder is displaced from the first to the second position after the third contact is interconnected with a contact of the other connector element, and such that on disengagement the contact holder is displaced from the second to the first position, the contacts being arranged such that on disengagement the first and second contacts separate before the third contact is separated from the said contact of the other connector element and such that when separated the first and second contacts are located within a closed chamber defined within the said at least one connector element, means being provided for locking the or each contact holder to the said contact of the other connector element unless the first and second contacts are separated.

Each connector element may support a respective first contact and a respective displaceable contact holder carrying interconnected second and third contacts such that on interengagement of the connector elements the third contacts are interconnected. Means may be provided to prevent the or each contact holder being blown out of the associated connector element. The preventing means may comprise a pin received in a slot formed in the contact holder.

The or each contact holder is preferably slidable in a bore such that the closed chamber is defined between the contact holder and the walls of that bore. Preferably, the locking means provided for locking the or each contact holder to the said contact of the other connector element comprise one or more locking balls which are retained in locking engagement between the connector elements and the contact holder unless the contact holder is in the first position.

Means may be provided for locking the or each contact holder in the first position when the connector elements are separated. Preferably the locking means maintains the or each contact holder in the first position unless the contact elements are interengaged, and may comprise a spring-biased slider displaceable as a

2A

result of interengagement of the connector elements from one position in which it retains one or more locking balls in locking engagement between the connector

CLAIMS

1. A connector for interconnecting or mutually isolating two or more circuits, comprising first and second interengageable connector elements each of which is connected in use to a respective circuit and at least one of which supports a first contact connected to the respective circuit and a displaceable contact holder carrying interconnected second and third contacts, the contact holder being displaceable between a first position in which the first and second contacts are separated and a second position in which the first and second contacts are interconnected, wherein the connector elements are formed such that on interengagement the contact holder is displaced from the first to the second position after the third contact is interconnected with a contact of the other connector element, and such that on disengagement the contact holder is displaced from the second to the first position, the contacts being arranged such that on disengagement the first and second contacts separate before the third contact is separated from the said contact of the other connector element and such that when separated the first and second contacts are located within a closed chamber defined within the said at least one connector element, means being provided for locking the or each contact holder to the said contact of the other connector elements unless the first and second contacts are separated.
2. A connector according to claim 1, wherein each connector element supports a respective first contact and a respective displaceable contact holder carrying interconnected second and third contacts such that on interengagement of the connector elements the third contacts are interconnected.
3. A connector according to claim 1 or 2, wherein means are provided to prevent the or each contact holder being blown out of the associated connector element.
4. A connector according to claim 3, wherein the preventing means comprises a pin received in a slot formed in the contact holder.



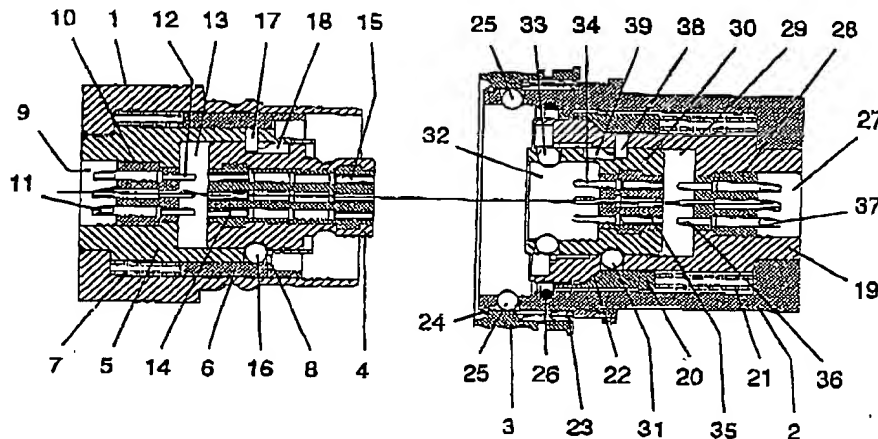
5. A connector according to any preceding claim, wherein the or each contact holder is slidable in a bore such that the closed chamber is defined between the contact holder and walls of the bore.
6. A connector according to any preceding claim, wherein the means for locking the or each contact holder to the said contact of the other connector elements comprise one or more locking balls which are retained in locking engagement between the connector element and the contact holder unless the contact holder is in the first position.
7. A connector according to any preceding claim, comprising means for locking the or each contact holder in the first position when the contact elements are separated.
8. A connector according to claim 7, wherein the locking means maintain the or each contact holder in the first position unless the contact elements are interengaged.
9. A connector according to claim 8, wherein the locking means comprise a spring-biased slider displaceable as a result of interengagement of the connector elements from one position in which it retains one or more locking balls in locking engagement between the connector element and the contact holder with the contact holder in the first position and a further position in which the or each locking ball is released and the contact holder is displaceable to the second position.
10. A connector substantially as hereinbefore described with reference to the accompanying drawings.

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(54) Title: ISOLATING CONNECTOR



(57) Abstract

A connector for interconnecting or mutually isolating two circuits one of which is connected to a first connector element (1) and the other of which is connected to a second connector element (2) which is interengageable with the first. One of the connector elements supports a first contact (12) connected to a respective circuit and a displaceable contact holder (4) carrying interconnected second (14) and third (15) contacts. The contact holder is displaceable between a first position in which the first (12) and second (14) contacts are separated and a second position in which the first and second contacts are interconnected. The connector elements are formed such that on interengagement the contact holder is displaced from the first to the second position after the third contact is interconnected with a contact (34) of the other connector element (2). The arrangement is such that on disengagement of the connector elements (1, 2) the contact holder is displaced from the second to the first position. The contacts are arranged such that on disengagement the first and second contacts separate before the third contact is separated from the other connector element and such that when separated the first and second contacts are located within a closed chamber defined within the connector element in which the contact holder is supported.

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⑤4 Stecker und/oder Buchse für einen elektrischen Steckverbinder

Steckverbinder, bestehend aus Stecker und Buchse,
wobei die elektrische Verbindung durch Einführen des Ste-
ckers beziehungsweise dessen Kontaktstiften in die Buchse
beziehungsweise deren korrespondierende Öffnungen her-
gestellt wird.

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Steckverbinder, bestehend aus Stecker und Buchse, wobei die elektrische Verbindung durch Einführen des Steckers beziehungsweise dessen Kontaktstiften in die Buchse beziehungsweise deren korrespondierende Öffnungen hergestellt wird, sind zum Beispiel aus der DE-A-35 12 026 und der DE-A-37 28 739 bekannt.

Der Steckverbinder nach der DE-A-37 28 739 ist so ausgebildet, daß er eine HF-Dichtigkeit, also einen EMP-Schutz beziehungsweise NEMP-Schutz ermöglicht. Der bekannte Steckverbinder hat sich im wesentlichen bewährt.

Um die Teile des Steckverbinders gegen elektromagnetische Störstrahlen zu schützen ist vorgesehen, den Stecker beziehungsweise die Buchse so auszubilden, daß sie mit angeschlossenen Bauteilen jeweils eine Art Faraday-Käfig bilden. Konkret wird dies bei dem bekannten Stecker dadurch erreicht, daß die Kontaktstifte im ungesteckten Zustand umfangsseitig eine innerhalb des Gehäusekörpers und mit dem Gehäusekörper elektrisch verbundene verschiebbare Einrichtung kontaktieren, wobei die Kontaktierung im gesteckten Zustand unterbrochen wird. Bei der zugehörigen Buchse sind die Kontaktstifte längsverschiebbar angeordnet und kontaktieren im ungesteckten Zustand eine ortsfest angeordnete Einrichtung aus elektrisch leitendem Material, die selbst wiederum in elektrischer Verbindung mit dem Gehäusekörper steht.

Aufgrund der Relativbewegung der Kontaktstifte zu der jeweiligen Einrichtung reiben die korrespondierenden, zueinander konzentrischen Flächen aneinander, was nach einer größeren Anzahl von Steckzyklen dazu führen kann, daß kein vollflächiger Kontakt mehr gegeben ist und Ströme nur noch teilweise abgeleitet werden können.

Entsprechend liegt der Erfindung die Aufgabe zugrunde, einen Steckverbinder der vorstehend genannten Art so auszubilden, daß die Reibung zwischen den relativ zueinander bewegten Teilen soweit wie möglich verringert, gleichzeitig aber der EMP- beziehungsweise NEMP-Schutz vollständig gewährleistet wird. Dabei sollen Stecker und Buchse des Steckverbinders möglichst so gestaltet sein, daß sie möglichst viele Kontakte auf kleinem Raum aufnehmen können.

Der Erfindung liegt die Erkenntnis zugrunde, daß Stecker und Buchse zu diesem Zweck so gestaltet sein müssen, daß ihre stiftförmigen Kontakte zwischen den Extrempositionen (Entriegelungsposition/Kontakt-/Steckposition) axial verschiebbar sind und in der Entriegelungsposition eine Stellung einnehmen, bei der sie gegen ein Element aus elektrisch leitendem Material zur Anlage kommen, so daß in diesem Zustand eine elektrische Verbindung der Kontakte untereinander über das Element und mit dem Gehäuse zu einem gehäuseseitigen Masseanschluß besteht. Dabei dient das Element gleichzeitig als Anschlag für die Kontakte zur Fixierung der Endposition der Kontakte im ungesteckten Zustand.

Es kommt also nicht mehr zu einer Reibung der elektrisch leitenden Abschnitte der Kontakte gegenüber dem elektrisch leitenden Element beim Steckvorgang; vielmehr wird die elektrische Verbindung zwischen den Kontakten und dem Element ohne irgendwelche Reibung unmittelbar in dem Moment gelöst, in dem der Steckvorgang eingeleitet wird. Im einzelnen wird hierzu auf die nachstehenden Ausführungen verwiesen.

In ihrer allgemeinsten Ausführungsform umfaßt die Erfindung einen Stecker und/oder eine Buchse für einen

- Stecker und/oder Buchse weisen mehrere, parallel zur Mittellängsachse und im Abstand zueinander verlaufende stiftförmige Kontakte auf,
- die Kontakte sind in Axialrichtung zwischen einer Kontaktposition (gesteckter Zustand) mit zugehörigen Anschlußkontakten sowie den Kontakten des anderen Teils des Steckverbinders und einer Entriegelungsposition (ungesteckter Zustand) ohne entsprechende Kontaktierungen verschiebbar,
- an dem elektrisch leitendem Gehäuse ist eine Platte aus elektrisch leitendem Material befestigt, die im wesentlichen senkrecht zu den Kontakten verläuft und Öffnungen aufweist, durch die die Kontaktstifte hindurchragen,
- dabei sind die Kontakte so angeordnet, daß sie in der Entriegelungsposition (ungesteckter Zustand) unter Vorspannung mit einem elektrisch leitenden, verdickten Abschnitt gegen die Platte anliegen, im übrigen aber (nach Einleitung des Steckvorgangs und im gesteckten Zustand) elektrisch isolierend gegenüber der Platte ausgebildet und angeordnet sind.

Die Kontaktstifte werden in der Regel einen Kreisquerschnitt aufweisen. In diesem Fall sollten auch die Öffnungen in der Platte kreisförmig sein. Der durch die Öffnungen hindurchragende Abschnitt der Kontaktstifte ist zur Vermeidung einer elektrischen Verbindung gegenüber der Platte umfangsseitig elektrisch isolierend ausgebildet.

In Steckrichtung vor der Platte weisen die Kontakte dann den genannten verdickten Abschnitt auf, der zumindest in seinem Kontaktbereich mit der Platte elektrisch leitend ausgebildet ist. Da die Platte gleichzeitig als Anschlag für die Kontaktstifte dienen soll, ergibt sich daraus implizit, daß der Querschnitt der verdickten Abschnitte der Kontaktstifte größer als der Querschnitt der korrespondierenden Durchgangsöffnung in der Platte ist. Über die nachstehend noch näher beschriebene Vorspannung der Kontaktstifte werden diese so mit ihrem verdickten Abschnitt gegen die elektrisch leitende Platte geführt. Über einen am Gehäuse befestigten Masseanschluß entsteht mit angeschlossenen Bauteilen eine Art Faraday-Käfig zur Ausbildung eines EMP/NEMP-Schutzes.

Um die Positionierung der Kontaktstifte gegenüber der Platte und damit gleichzeitig gegenüber den Kontakten des zugehörigen Teils des Steckverbinders zu optimieren wird vorgeschlagen, auf der dem verdickten Abschnitt der Kontakte zugewandten Seite die Öffnungen konisch auszubilden und die verdickten Abschnitte der Kontakte mit korrespondierenden Schrägflächen auszubilden. Es entsteht so eine Art Zentrierung für die Kontaktstifte bei ihrer Bewegung gegen die Öffnungen in der Platte.

Die Zentrierung und die Kontaktierung können weiter verbessert werden, wenn die korrespondierenden Flächen von Öffnungen und/oder verdickten Abschnitten mit elektrisch leitenden, federnden Lamellen belegt sind. Die Kontaktstifte werden dann im entriegelten Zustand gegen die federnden Lamellen gedrückt, wodurch etwaige Toleranzen sicher ausgeglichen werden. Die Lamellen können dabei in Form eines Lamellenrings gestaltet sein, wobei die äußeren Enden der Lamellen an dem zugehörigen Teil (der Platte, dem verdickten Abschnitt) befestigt sind, während die in Steckrichtung vor-

deren Enden etwas von der zugehörigen Fläche abragen und dadurch federnd sind.

Bezüglich der Anordnung der Kontakte innerhalb des Gehäuses von Stecker und Buchse sind verschiedene Ausführungsformen möglich. Auf jeden Fall ist sicherzustellen, daß die Kontakte gegeneinander elektrisch isolierend angeordnet sind (ausgenommen im Entriegelungszustand), wobei die Kontakte vorzugsweise in einem gemeinsamen Körper innerhalb des Gehäuses angeordnet sind. Der Körper besteht dabei aus einem isolierenden Material, zum Beispiel einem Kunststoff.

Der Körper kann insgesamt zwischen gehäusefesten Anschlüssen gegen die Kraft einer Feder verschiebbar angeordnet sein und nimmt dann entsprechend die Kontakte mit oder aber die einzelnen Kontakte sind zwischen körperfesten Anschlüssen gegen die Kraft korrespondierender Federn verschiebbar. Dabei werden die Federn so ausgebildet, daß die Kontaktstifte im ungesteckten Zustand gegen die Platte anliegen, aber von den Anschlußkontakten gelöst sind, während im gesteckten Zustand die elektrische Verbindung der Kontakte untereinander über die Platte gelöst ist und die Kontakte gegen die Anschlußkontakte anliegen.

Der Kontaktbereich zwischen den einzelnen Kontakten und den zugehörigen Anschlußkontakten wird vorzugsweise wieder so ausgebildet, daß Toleranzen ausgeglichen werden können. Dabei bietet sich die Anordnung weiterer Lamellenringe, wie sie vorstehend beschrieben wurden, im Bereich der Stirnflächen der Kontakte und/oder Anschlußkontakte an.

Die feste Positionierung der Kontakte innerhalb des Körpers kann dadurch erfolgen, daß die Kontakte von einem entsprechenden Kunststoffmaterial umspritzt werden. Dabei ist es besonders vorteilhaft, wenn zumindest der steckseitige Abschnitt des Körpers aus einem deformierbaren Material besteht, wodurch Verformungen beim Kontaktieren der Platte beziehungsweise der Anschlußkontakte aufgenommen werden können.

Die beschriebene Ausführungsform von Buchse und/oder Stecker ermöglicht es mit einfachen Mitteln, die Teile im ungesteckten Zustand vor elektromagnetischen Störstrahlen zu schützen. Dabei sind Stecker und Buchse so aufgebaut, daß sie auf engstem Raum eine Vielzahl von Kontakten aufnehmen können, ohne die Sicherheit der Einrichtung zu gefährden.

In verschiedenen Anwendungsbereichen müssen Steckverbinder der genannten Art zwischen den einzelnen Steckvorgängen auf ihre Funktionstüchtigkeit geprüft werden, um Fehler und Störungen rechtzeitig entdecken zu können. Dabei sollen häufig verschiedene Funktionsgruppen getrennt voneinander getestet werden. Im Stand der Technik ist dies nur mittels aufwendiger externer Meßgeräte möglich, deren Einsatz aufgrund von Platz- oder Zeitproblemen jedoch nicht immer akzeptiert werden kann.

Gemäß einer vorteilhaften Weiterbildung der Erfindung ist vorgesehen, die Anschlußkontakte nur in ihrem Kontaktbereich zu den korrespondierenden Kontakten auch umfangsseitig aus einem elektrisch leitenden Material auszubilden, während die übrigen Abschnitte einen Isoliermantel aufweisen. Bei dieser Ausführungsform können über die Umfangsflächen der Anschlußkontakte einzelne Anschlußkontakte untereinander oder in vorwählbaren Gruppen miteinander kurzgeschlossen werden. Zu diesem Zweck weist der die Kontakte aufnehmende Körper an seinem, den Anschlußkontakten zugewandten Ende axiale Kanäle auf, die die Anschlußkontakte übergreifen und innenseitig mit elek-

trisch leitenden Elementen ausgebildet sind, die im ungesteckten Zustand bestimmte Anschlußkontakte miteinander elektrisch verbinden, eine elektrische Verbindung zu den Kontakten aber unterbinden, während diese Elemente im gesteckten Zustand gegen die umfangsseitig isolierten Abschnitte der Anschlußkontakte anliegen. Es ist offensichtlich, daß eine solche Ausführungsform dann realisiert werden kann, wenn der Körper insgesamt im Gehäuse verschiebbar angeordnet ist. Die Elemente sind vorzugsweise Federelemente aus elektrisch leitendem Material, die eine sichere Kontaktierung gewährleisten.

Weitere Merkmale der Erfindung ergeben sich aus den Merkmalen der Unteransprüche sowie den sonstigen Anmeldungsunterlagen.

Die Erfindung wird nachstehend anhand zweier Ausführungsbeispiele näher erläutert. Dabei zeigt die Zeichnung in stark schematisierter Darstellung in

Fig. 1 einen Schnitt durch einen aus Buchse und Stecker bestehenden Steckverbinder, wobei in der oberen Hälfte der gesteckte und in der unteren Hälfte der ungesteckte Zustand dargestellt ist, sowie in,

Fig. 2 eine weitere Ausführungsform ebenfalls in gestecktem Zustand (obere Hälfte) beziehungsweise ungestecktem Zustand (untere Hälfte).

In den Figuren sind gleiche oder gleichwirkende Bauteile mit gleichen Bezugsziffern dargestellt.

In Fig. 1 beschreibt das Bezugszeichen 10 eine Buchse, das Bezugszeichen 12 einen Stecker eines elektrischen Steckverbinders.

Buchse 10 und Stecker 12 weisen jeweils ein Metallgehäuse 14 auf, in dem ein Isolierkörper 16 ortsfest angeordnet ist. Der Isolierkörper 16 wird in der Buchse 10 zum Stecker 12 hin durch eine Platte 18 und am gegenüberliegenden Ende durch einen Boden 20, ebenfalls aus einem isolierenden Material, hier Kunststoff, fixiert.

Im Boden 20 liegen Anschlußkontakte 22, die die Buchse 10 anschlussseitig überragen und die zum Isolierkörper 16 hin in axial verlaufende Kanäle 24 hineinragen.

Der Boden 20 weist in seinem zum Isolierkörper 16 gerichteten Abschnitt Öffnungen 26 auf, die einen größeren Querschnitt besitzen als die anschlussseitigen Öffnungen 28 zur Aufnahme der Anschlußkontakte 22. Die Öffnungen 26 dienen dazu, einen verdickten Abschnitt 30 der Anschlußkontakte 22 aufzunehmen, wobei die verdickten Abschnitte 30 vom anschlussseitigen Ende in Richtung auf den Isolierkörper 16 durch Federn 32 beaufschlagt werden. Der Isolierkörper 16 bildet dabei einen Anschlag für die verdickten Abschnitte 30 in Richtung auf den Stecker 12.

In den Kanälen 24 liegen Kontakte 34 ein, deren Querschnitt dem Querschnitt des Basisabschnittes der Anschlußkontakte 22 entspricht. Auch die Kontakte 34 besitzen einen verdickten Abschnitt 36 etwa auf der Hälfte ihrer axialen Erstreckung. Zu diesem Zweck sind die Kanäle 24 in dem in der Figur rechten Abschnitt des Isolierkörpers 16 mit einem erweiterten Querschnitt ausgebildet. Hierdurch wird ein Ringkanal 38 ausgebildet, in dem jeweils eine Druckfeder 40 einliegt, die sich anschlussseitig gegen eine Stufe 42 des Isolierkörpers 16 und zum Stecker 12 hin gegen den verdickten Abschnitt 36 der Kontakte 34 abstützt.

Die Druckfedern 40 bewirken, daß die Kontakte im ungesteckten Zustand (unterer Teil von Fig. 1) nach rechts gedrückt werden, wobei der vordere Abschnitt der Kontakte 34 Öffnungen 44 in der Platte 18 durchragt, während die verdickten Abschnitte 36 gegen die

Platte 18 anliegen.

Wie Fig. 1 zeigt, sind die korrespondierenden Flächenabschnitte von Öffnungen 44 und verdickten Abschnitten 36 mit Schrägflächen ausgebildet, so daß der hierdurch ausgebildete Konus jedes verdickten Abschnittes 36 gegen die korrespondierende konische Fläche der zugehörigen Öffnung 44 anliegt. Auf diese Weise wird gleichzeitig eine Zentrierung der Kontakte 34 erreicht.

Im ungesteckten Zustand sind die Kontakte 34 von den Anschlußkontakten 22 getrennt, wobei die Anschlußkontakte 22 durch die Federn 32 mit ihren verdickten Abschnitten 30 gegen den Isolierkörper 16 anliegen.

Die Kontakte 34 sind mit Ausnahme der Kontaktenden 34a, 34b und der verdickten Abschnitte 36 umfangsseitig mit einem Isoliermantel 46 ausgebildet.

In der dargestellten Position (ungesteckter Zustand) wird über die Platte 18 und die verdickten Abschnitte 36 eine durchgehende elektrische Verbindung in das Metallgehäuse 14 und einen Masseanschluß 48 erreicht, wodurch eine Art Faraday-Käfig für einen EMP- beziehungsweise NEMP-Schutz ausgebildet wird.

Wird der korrespondierende Stecker 12 auf die Buchse 10 geführt, so kontaktieren die Kontakte 34 des Steckers 12 zunächst die Abschnitte 34a der Kontakte 34 der Buchse 10 und drücken diese gegen den Widerstand der Federn 40 in Richtung auf die Anschlußkontakte 22, bis eine elektrische Verbindung zwischen den Kontakten 34 der Buchse 10 und den zugehörigen Anschlußkontakten 22 erfolgt (oberer Teil von Fig. 1) und die Anschlußkontakte 22 gegen den Widerstand der Federn 32 weggedrückt werden.

Bereits zuvor wurden die verdickten Abschnitte 36 von der Platte 18 gelöst und damit die elektrische Verbindung der Kontakte 34 untereinander aufgehoben.

Der Stecker 12 kann entweder mit festliegenden Kontakten 34 ausgebildet werden, ebenso ist es aber auch möglich, die einzelnen Kontakte wie bei der Buchse 10 über Druckfedern zu führen, die dann vorzugsweise eine höhere Federkonstante als die Federn 40 und/oder die Federn 32 aufweisen, um die Buchsenkontakte 34 beim Steckvorgang entsprechend vordrücken zu können.

Eine alternative Ausführungsform von Buchse und Stecker zeigt Fig. 2. Hier sind die Buchsenkontakte 34 ortsfest im Isolierkörper 16 angeordnet und der Isolierkörper 16 selbst wird über eine Druckfeder 40 verschiebbar im Gehäuse 14 geführt. Zu diesem Zweck weist der Isolierkörper 16 umfangsseitig einen Absatz 50 auf, wodurch wiederum eine Art Ringkanal 51 gebildet wird, in dem die Druckfeder 40 einliegt. Der Isolierkörper 16 ist schmaler als beim Ausführungsbeispiel nach Fig. 1 ausgebildet, um eine Bewegbarkeit zwischen der Platte 18 und dem Boden 20 zu gewährleisten.

Aus Montagegründen ist der Boden 20 hier zweiteilig ausgebildet.

Ein weiterer Unterschied zum Ausführungsbeispiel nach Fig. 1 besteht darin, daß im Bereich der Öffnungen 44 auf der Platte 18 Metalllamellen 52 angeordnet sind, wobei die einzelnen Lamellen im gesteckten Zustand (oberer Teil von Fig. 2) etwas von der Schrägfläche der Öffnung 44 abstehen. Dies hat den Vorteil, daß im ungesteckten Zustand (unterer Teil von Fig. 2) die Kontakte mit ihren verdickten Abschnitten 36 die Lamellen 52 etwas vor dem eigentlichen Flächenkontakt kontaktieren und anschließend gegen ihre Federkraft gegen die Schrägfläche der zugehörigen Öffnung 44 drücken, wo-

durch eine besonders intensive elektrische Verbindung und gleichzeitige Positionierung der Kontakte 34 gegenüber der Platte 18 erreicht wird.

Fig. 2 zeigt weiter, daß auch die Kontakte 34 des Steckers 12 gegen die Kraft zugehöriger Federn 54 in Richtung auf die Buchse 12 beaufschlagt sind und innerhalb korrespondierender Öffnungen 56 im Isolierkörper 16 axial verschiebbar einliegen.

Während der ungesteckte Zustand im wesentlichen dem nach Fig. 1 entspricht, werden die Kontakte 34 des Steckers 12 beim Stecken von Buchse 10 und Stecker 12 gegen die Kraft der Federn 54 etwas zum anschlußseitigen Ende axial weggedrückt, wodurch Toleranzen besser ausgeglichen werden können, um einen sicheren Steckzustand in der Verriegelungsstellung zwischen Buchse 10 und Stecker 12 zu erreichen.

Auch beim Ausführungsbeispiel nach Fig. 2 wird aber gewährleistet, daß unmittelbar nach dem Kontaktieren zugehöriger Kontakte 34 von Stecker 12 und Buchse 10 die verdickten, elektrisch leitenden Abschnitte 36 der Kontakte 34 von den Lamellen 52 beziehungsweise der Platte 18 gelöst werden, bevor die Kontakte 34 über ihre Enden 34b die Anschlußkontakte 22 kontaktieren.

Wie vorstehende Funktionsbeschreibung zeigt, stoßen die korrespondierenden Flächen jedes verdickten Abschnittes 36 mit der zugehörigen Schrägfläche der Öffnung 44 nur flächig aufeinander, so daß jegliche Reibung verhindert wird. Durch die konische Ausbildung wird gleichzeitig eine Zentrierung erreicht. Wird der Isolierkörper 16 zumindest abschnittsweise aus einem elastischen Material hergestellt, lassen sich etwaige Toleranzen zusätzlich ausgleichen. Die beschriebene Anordnung der Kontakte 34 ermöglicht es, auf kleinstem Raum eine Vielzahl von Kontakten innerhalb des Gehäuses 14 anzuordnen.

Patentansprüche

1. Stecker (12) und/oder Buchse (10) für einen elektrischen Steckverbinder mit mehreren, parallel zur Mittenlängsachse und im Abstand zueinander verlaufenden stiftförmigen Kontakten (34), die in Axialrichtung zwischen einer Kontaktposition mit zugehörigen Anschlußkontakten (22) sowie den Kontakten (34) des anderen Teils des Steckverbinders und einer Entriegelungsposition ohne entsprechende Kontaktierungen verschiebbar sind und dabei Öffnungen (44) in einer, im wesentlichen senkrecht zu den Kontakten (34) verlaufenden, am elektrisch leitenden Gehäuse (14) befestigten Platte (18) aus elektrisch leitendem Material durchragen, wobei die Kontakte (34) so geführt sind, daß sie in der Entriegelungsposition unter Vorspannung mit einem elektrisch leitenden, verdickten Abschnitt (36) gegen die Platte (18) anliegen, im übrigen aber elektrisch isolierend gegenüber der Platte (18) ausgebildet und angeordnet sind.
2. Stecker und/oder Buchse nach Anspruch 1, wobei die Öffnungen (44) auf der dem verdickten Abschnitt (36) der Kontakte (34) zugewandten Seite konisch angefast sind und die verdickten Abschnitte (36) der Kontakte (34) korrespondierende Schrägflächen aufweisen.
3. Stecker und/oder Buchse nach Anspruch 1 oder 2, bei denen die korrespondierenden Flächen von Öffnungen (44) und/oder verdickten Abschnitten (36) mit elektrisch leitenden, federnden Lamellen (52) belegt sind.

4. Stecker und/oder Buchse nach Anspruch 3, bei denen die Lamellen (52) im wesentlichen konzentrisch zur Mittenlängsachse des zugehörigen Kontaktes (34) ausgebildet sind.
5. Stecker und/oder Buchse nach einem der Ansprüche 1 bis 4, bei denen die Kontakte (34) gegeneinander elektrisch isolierend, in einem gemeinsamen Isolierkörper (16) innerhalb des Gehäuses (14) angeordnet sind.
6. Stecker und/oder Buchse nach Anspruch 5, bei denen der Körper (16) zwischen gehäusefesten Anschlägen (20, 18) gegen die Kraft einer Feder (40) verschiebbar angeordnet ist.
7. Stecker und/oder Buchse nach Anspruch 5 oder 6, bei denen die einzelnen Kontakte (34) zwischen körperfesten Anschlägen (42, 18) gegen die Kraft korrespondierender Federn (40) verschiebbar angeordnet sind.
8. Stecker und/oder Buchse nach einem der Ansprüche 1 bis 7, bei denen die Kontakte (34) so ausgebildet und angeordnet sind, daß sie nur in vollständig gestecktem Zustand des Steckverbinders elektrisch leitend gegen die korrespondierenden Anschlußkontakte (22) anliegen.
9. Stecker und/oder Buchse nach einem der Ansprüche 1 bis 8, bei denen die Kontakte (34) und/oder zugehörigen Anschlußkontakte (22) an ihren korrespondierenden Stirnflächen elastisch ausgebildet sind.
10. Stecker und/oder Buchse nach Anspruch 9, bei denen die Stirnflächen topfartig ausgebildet sind und radial verlaufende Lamellen aufweisen, die randseitig befestigt und an ihrem inneren freien Ende biegsam sind.
11. Stecker und/oder Buchse nach einem der Ansprüche 5 bis 10, bei denen der Körper (16) zur Aufnahme der Kontakte (34) zumindest an seinem steckseitigen Ende aus einem deformierbaren Material besteht.
12. Stecker und Buchse nach einem der Ansprüche 1 bis 11, bei denen die Anschlußkontakte (22) außerhalb ihres Kontaktbereiches mit den Kontakten (34) einen elektrischen Isoliermantel aufweisen und der die Kontakte (34) aufnehmenden Körper (16) mit elektrisch leitenden Elementen ausgebildet ist, die im ungesteckten Zustand des Steckverbinders einzelne Anschlußkontakte (22) in vorwählbarer Zuordnung kurzschließen, während die Elemente im gesteckten Zustand des Steckverbinders gegen den Isoliermantel der Anschlußkontakte (22) anliegen.

Hierzu 1 Seite(n) Zeichnungen

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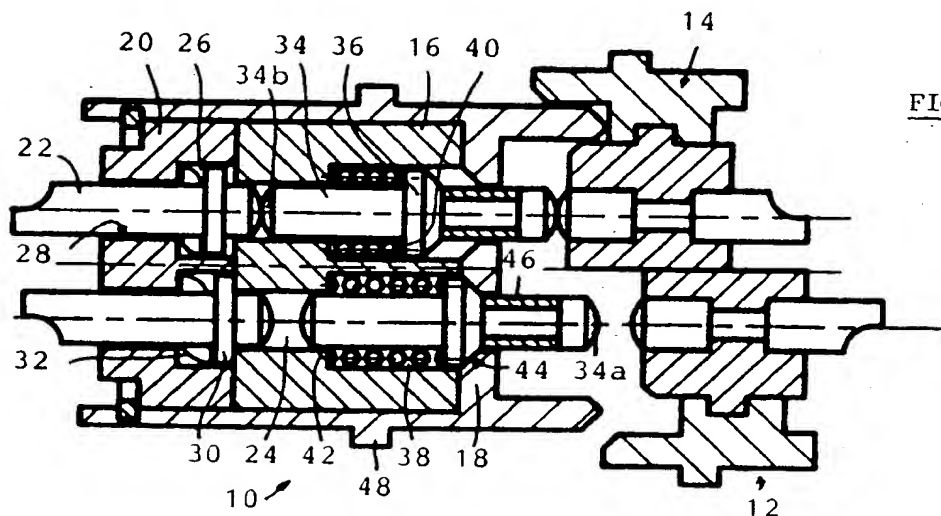


FIG. 1

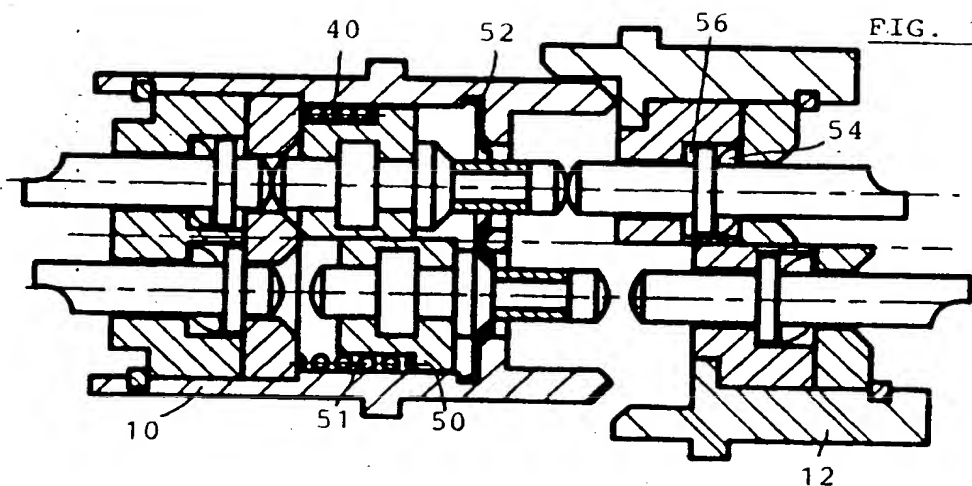


FIG. 1

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ISOLATING CONNECTOR

The present invention relates to an isolating connector for interconnecting or mutually isolating two or more circuits.

Electrical connectors are required which can be used safely in applications where the connectors may be exposed to explosive atmospheres. Such applications are found in industrial plants, for example in the oil, gas, petrochemical and mining industries.

Industrial plants are zoned according to the likelihood of explosive gases being present. Various protection measures are used to prevent explosions. The International Electrotechnical Commission (IEC) has established standards which should be applied in particular circumstances, for example the Exd standard. Connectors in accordance with the Exd standard should be capable of being used in an explosive atmosphere such that if two interengageable connector elements of the connector are separated and a spark is generated any resultant explosion occurs within the connector structure and is prevented from being transmitted to the surrounding environment. To meet these standards, the connector must be capable of withstanding pressure developed within the connector as a result of an internal explosion and preventing the transmission of the explosion along any flame path defined between components of the connector. Exd standard connectors are available at present but generally meet the standard requirements only if prior to disconnection of the connector elements no power is supplied to the connector elements. To prevent accidental disconnection when power is still being supplied to the connector, such connectors must be marked clearly with for example "do not separate when energised" and the connector elements must be secured together by means of special fasteners which prevent accidental release.

It is an object of the present invention to provide a connector which can meet stringent safety requirements even if elements of the connector are separated when still connected to a source of electrical energy.

According to the present invention, there is provided a connector for interconnecting or mutually isolating two or more circuits, comprising first and second interengageable connector elements each of which is connected in use to a



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respective circuit and at least one of which supports a first contact connected to the respective circuit and a displaceable contact holder carrying interconnected second and third contacts, the contact holder being displaceable between a first position in which the first and second contacts are separated and a second position in which the first and second contacts are interconnected, wherein the connector elements are formed such that on interengagement the contact holder is displaced from the first to the second position after the third contact is interconnected with a contact of the other connector element, and such that on disengagement the contact holder is displaced from the second to the first position, the contacts being arranged such that on disengagement the first and second contacts separate before the third contact is separated from the said contact of the other connector element and such that when separated the first and second contacts are located within a closed chamber defined within the said at least one connector element.

Each connector element may support a respective first contact and a respective displaceable contact holder carrying interconnected second and third contacts such that on interengagement of the connector elements the third contacts are interconnected. Means may be provided to prevent the or each contact holder being blown out of the associated connector element. The preventing means may comprise a pin received in a slot formed in the contact holder.

The or each contact holder is preferably slidable in a bore such that the closed chamber is defined between the contact holder and the walls of that bore. Means may be provided for locking the or each contact holder to the said contact of the other connector element unless the first and second contacts are separated. Preferably, the locking means comprise one or more locking balls which are retained in locking engagement between the connector elements and the contact holder unless the contact holder is in the first position.

Means may be provided for locking the or each contact holder in the first position when the connector elements are separated. Preferably the locking means maintains the or each contact holder in the second position unless the contact elements are interengaged, and may comprise a spring-biased slider displaceable as a result of interengagement of the connector elements from one position in which it retains one or more locking balls in locking engagement between the connector

element and the contact holder with the contact holder in the first position and a further position in which each locking ball is released and the contact holder is displaceable to the second position.

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which;

Figure 1 is an outside view of the two connector elements making up a connector in accordance with one embodiment of the present invention;

Figure 2 is a sectional view through the connector assembly of Figure 1;

Figures 3 to 9 illustrate successive stages in the interconnection of the connector element shown in Figures 1 and 2; and

Figures 10 to 15 illustrate the sequence of component movements which is followed as the two connector elements are separated.

Referring to Figure 1, the illustrated connector assembly comprises a male connector having an outer body 1 and a female connector having an outer body 2. A collar 3 is slidably supported on the female connector outer body 2. The tip of a male body sliding contact holder 4 is also visible.

Referring to Figure 2, this view corresponds to that of Figure 1 but shown in axial section to reveal the internal structure of the male and female connectors. The male connector outer body 1 fixedly supports a male connector inner body 5, an annular recess being defined between the inner and outer bodies. A male connector slider 6 is slidably received within the recess between the inner body 5 and the outer body 1 and a series of compression springs 7 biases the slider 6 against a flange 8 supported by the inner body 5. The inner body 5 defines a socket 9 in which a male connector fixed contact holder 10 is received. Cable solder pots 11 extend into the socket 9, and the holder 10 supports first male contact pins 12 which project into a further socket 13 defined by the inner body 5.

The pins 12 face first female contacts 14 supported in the sliding contact holder 4. The sliding contact holder 4 also supports second female contacts 15 which are electrically connected to the first female contacts 14. The holder 4 is slidable within the socket 13 but is retained in the position shown in Figure 2 by a lock ball 16. The maximum spacing between the pins 12 and the first female contacts 14 is determined by the position of a retention pin 17 that is received within a slot 18

formed on the outer surface of the holder 4. The pin 17 is fixedly mounted in the male connector inner body 5, providing radial orientation and preventing total withdrawal of the sliding contact holder 4 from the inner body 5.

The female connector outer body 2 fixedly supports a female connector inner body 19. An annular slot is defined between the outer body 2 and the inner body 19 and receives a female connector slider 20 which is biased by a compression spring 21 against a frusto conical surface 22 defined by the inner body 19. A compression spring 23 biases the collar 3 against a retaining circlip 24. A lock ball 25 is supported in a tapering opening in the female connector outer body 2. An O-ring seal 26 is also provided in an annular groove inside the open end of the female connector outer body 2.

The female connector inner body 19 defines a socket 27 which receives a female connector fixed contact holder 28. The inner body 19 also defines a socket 29 which slidably receives a female connector sliding contact holder 30. In the separated condition of the connector assembly the sliding contact holder 30 is locked in position by a lock ball 31. The sliding contact holder 30 defines a socket 32 the wall of which carries lock balls 33 and into which second male contact pins 34 project. The pins 34 are connected to third female contacts 35 also carried by the sliding contact holder 30. The third female contacts 35 face third male contact pins 36 extending from the fixed contact holder 28. The third male contact pins 36 are connected to cable solder pots 37 which project into the socket 27.

The maximum spacing between the third female contacts 35 and the third male contact pins 36 is determined by retention pin 38 carried by the inner body 19. The retention pin 38 is received in an elongate slot 39 formed in the outer surface of the female connector sliding contact holder 30. The pin 38 provides radial orientation and prevents total withdrawal of the contact holder 30 from the inner body 19.

Referring now to Figures 3 to 9, the interaction of the various components described with reference to Figure 2 as the male and female connectors are brought together will be described. As the tip of the male connector outer body 1 is advanced into the female connector body 2 the lock balls 33 are pushed radially outwards and the O-ring seal 26 is compressed. The tip of the male connector outer body 1 then contacts one end of the female connector slider 20. As the male connector is

advanced further into the female connector the slider 20 is pushed back against the compression spring 21. Initially the lock ball 31 secures the sliding contact holder 30 against axial displacement and as a result the male connector sliding contact holder 4 which in turn is locked against axial displacement by lock ball 16 advances so as to push the second female contacts 15 onto the second male contact pins 34. Once the female connector slider 20 has moved far enough against the biasing force of the spring 21 the lock ball 31 can move away from the female connector sliding contact holder 30 so as to enable axial displacement of the contact holder 30. Figure 4 shows the assembly just after the lock ball 31 has released the holder 30 for axial displacement.

Referring to Figure 5, as the male connector is pushed further into the female connector, the slider 20 is pushed back further against the biasing force of the spring 21 and the contact holder 30 advances towards the third male contact pins 36. As a result the retention pin 38 is no longer at one end of the slot 39.

As shown in Figure 6, further advancement of the male connector pushes the third female contacts 35 onto the third male contacts 36. The lock ball 16 still prevents axial displacement of the male connector sliding contact holder 4.

Figure 7 shows the relative positions of the various components immediately after the female connector sliding contact holder 30 has been pushed up against the bottom of the socket 29 defined by the inner body 19 of the female connector. It will be seen that the tip 40 of the inner body 19 has pushed the male connector slider 6 back against the biasing force of the spring 7 to a sufficient extent that the lock ball 16 can move out of engagement with the male connector sliding contact holder 4. Further advancement of the male connector outer body 1 into the female connector causes further compression of the spring 7 as shown in Figure 8 until the first male contact pins 12 enter the first female contacts 14. The male connector is then pushed fully home to the position shown in Figure 9, in which position the lock balls 25 are pushed into an annular depression formed in the outer body 1 of the male connector, the lock balls 25 being retained in position by the collar 3 which is pushed over the lock balls 25 by the spring 23. Thus the cable solder pots 11 are directly connected to the cable solder pots 37 through a series of three connections each defined by male contact pins received in female contacts.

Referring now to Figures 10 to 15, the sequence of component movement which is followed as the male and female connectors are separated will be described. Firstly, as shown in Figure 10, the collar 3 is pulled back to release the lock balls 25. Tension is then applied between the collar 3 and the outer body 1 of the male connector so as to pull the two halves of the connector apart. The lock balls 33 prevent separation of the male connector sliding contact holder 4 and the female connector sliding contact holder 30. Thus the tension is applied to the connections between the first male pins 12 and female contacts 14 and the third male pins 36 and the female contacts 35. Depending upon which of these two pin and female contact connections presents the greatest frictional resistance to separation, either the pins 36 will be pulled out of the female contacts 35 as shown in Figure 10 or the pins 12 will be pulled out of the female contacts 14 as shown in Figure 11 (Figure 11 shows only the internal components of the connector). Further separation of the male and female connector parts moves the assembly to the position as shown in Figure 12 (if initial separation was between pins 36 and female contacts 35 as shown in Figure 10) or moves the components of the assembly to the relative positions shown in Figure 13 (if initial separation was between the pins 12 and the female contacts 14 as shown in Figure 11). Thus the two contact holders which are locked together have been separated from either the male connector fixed contact holder 10 or the female connector fixed contact holder 28.

The male and female connector sliding contact holders remain locked together and thus as the male and female connectors are pulled further apart the assembly components assume the condition shown in Figure 14 in which the locked-together sliding contact holders are electrically isolated from the first male connector pins 12 and the third male connector pins 36. As the male and female connector parts are pulled further apart to the positions shown in Figure 14 the lock balls 33 are released and as a result the two sliding contact holders 4 and 30 can separate as shown in Figure 15. As a result the second male contact pins 34 are pulled out of the second female contacts 15. All three sets of male pins and female contacts are thus separated and further separation of the two halves of the connector can then proceed.

Assuming that when making or breaking a connection with the illustrated connector power is applied between the cable solder ports 11 and 37, connection or

disconnection of the connector assembly will nevertheless be achieved in a safe manner. For example, if as shown in Figure 12 the electrical circuit is broken first as a result of separation of the male pins 36 and the female contacts 35, any resultant spark will be generated in the closed compartment defined around the pins 36. Even if that compartment is filled with an explosive mixture of gas which is ignited as a result of spark generation, the volume of gas ignited will be relatively small. A gas explosion in the closed compartment will result in an axial force being applied to the female connector sliding contact holder 30 but that contact holder will be prevented from being blown out of the assembly as a result of interengagement between the retaining pin 38 and the slot 39. Heat generated by the confined explosion will be rapidly absorbed by the connector body, and the length of any leakage path from the closed compartment in which the explosion has occurred to the exterior of the connector will be such that the explosion cannot be propagated to the atmosphere outside the connector. Similarly, if the first break in the electrical connection through the connector assembly is a result of the pins 12 being pulled out of the female contacts 14 as shown in Figure 13, any spark will be generated in the closed compartment defined around the pins 12 and the male connector sliding contact holder 4 will be retained within the connector body by interaction between the retaining pins 17 and the slot 18. Further separation of the device will result in the separation of two further sets of male pins and female contacts but no voltage will be applied across those connections at the time of separation and accordingly no further sparks can be generated. The overall assembly is thus inherently secure against the risk of sparks being generated in a manner which could cause explosions to propagate outside the connector body.

Once the connector has been disconnected the two halves of the connector are in the condition as illustrated in Figure 2. In that condition, the male connector sliding contact holder 4 is locked against axial displacement by the lock ball 16 and the female connector sliding contact holder 30 is locked against axial displacement by the lock ball 31. Thus even if a user was to inadvertently apply an axial force to one of the contact holders the contact holder would not be displaced axially and therefore could not make an electrical connection with any cable connected to the respective connector half. The overall assembly is thus inherently very secure against threats

either to the safety of users or to the generation of explosions which could propagate to the surrounding environment.

It will be appreciated that alternative arrangements to those described in Figures 1 to 15 can be envisaged. For example sprung contact arrangements could be used in place of the illustrated pins and sockets. Spring loaded arrangements could be provided to apply a bias force to assist separation of particular pins and sockets in a predetermined order. A captive screw thread ring nut or staplelock system could be used to hold the collar 3 in a locked position so as to reduce the risk of inadvertent connector separation. The sliding collars 6 and 20 could be multi-component assemblies. Furthermore, although in the illustrated connector only straightforward electrical connections are required, the connector could be used for combined electrical/fibre optic connection or for a fibre optic connection only. Combined connectors could also include pneumatic and/or hydraulic connections.

Further modifications to the illustrated connector arrangement are possible. For example, the springs of the illustrated embodiment could be replaced by foam rubber, compressable gas arrangements or a single large spring. The annular collars could be replaced by sliding rods or the like. Locking balls could be replaced by shaped pin or other locking elements. The retention posts could be replaced by anchor bolts, circlips, machine legs or lips or the like. Collars could be split into a series of independent elements to improve security against tampering. In the illustrated arrangement, the retention posts slide in axial slots which limit the maximum axial displacement of the contact holders. Other arrangements are possible however. For example a spring-loaded retention post could be slidable in a slot incorporating a first axially extending slot section and a second slot section which is inclined at an acute angle to the axial section. With such an arrangement if when the contact elements were disconnected an attempt was made to push back the contact holder, the springloaded retention post could cause the pin holder to rotate into a locked position, thereby preventing reconnection of the pins. With such an arrangement, the springloading would cause rotation of the contact holder unless the contact holder was prevented from turning as a result of interengagement with components of the other connector elements. For example, pins mounted on one contact element would engage in sockets of the contact holder of the other contact

elements so as to prevent rotation of the contact holder. Such an arrangement would not positively lock the contact holders against axial displacement before connector element interengagement as is the case for the illustrated embodiment.

It will be appreciated that connectors in accordance with the invention may be provided with air or inert gas purging, to prevent the build-up of explosive gas mixtures in the closed chambers in which sparks may be generated, or the closed chambers may be filled with a non-flammable electrically insulating liquid.

CLAIMS

1. A connector for interconnecting or mutually isolating two or more circuits, comprising first and second interengageable connector elements each of which is connected in use to a respective circuit and at least one of which supports a first contact connected to the respective circuit and a displaceable contact holder carrying interconnected second and third contacts, the contact holder being displaceable between a first position in which the first and second contacts are separated and a second position in which the first and second contacts are interconnected, wherein the connector elements are formed such that on interengagement the contact holder is displaced from the first to the second position after the third contact is interconnected with a contact of the other connector element, and such that on disengagement the contact holder is displaced from the second to the first position, the contacts being arranged such that on disengagement the first and second contacts separate before the third contact is separated from the said contact of the other connector element and such that when separated the first and second contacts are located within a closed chamber defined within the said at least one connector element.
2. A connector according to claim 1, wherein each connector element supports a respective first contact and a respective displaceable contact holder carrying interconnected second and third contacts such that on interengagement of the connector elements the third contacts are interconnected.
3. A connector according to claim 1 or 2, wherein means are provided to prevent the or each contact holder being blown out of the associated connector element.
4. A connector according to claim 3, wherein the preventing means comprises a pin received in a slot formed in the contact holder.
5. A connector according to any preceding claim, wherein the or each contact holder is slidable in a bore such that the closed chamber is defined between the contact holder and walls of the bore.

6. A connector according to any preceding claim, comprising means for locking the or each contact holder to the said contact of the other connector elements unless the first and second contacts are separated.
7. A connector according to claim 6, wherein the locking means comprise one or more locking balls which are retained in locking engagement between the connector element and the contact holder unless the contact holder is in the first position.
8. A connector according to any preceding claim, comprising means for locking the or each contact holder in the second position when the contact elements are separated.
9. A connector according to claim 8, wherein the locking means maintain the or each contact holder in the second position unless the contact elements are interengaged.
10. A connector according to claim 9, wherein the locking means comprise a spring-biased slider displaceable as a result of interengagement of the connector elements from one position in which it retains one or more locking balls in locking engagement between the connector element and the contact holder with the contact holder in the first position and a further position in which the or each locking ball is released and the contact holder is displaceable to the second position.
11. A connector substantially as hereinbefore described with reference to the accompanying drawings.

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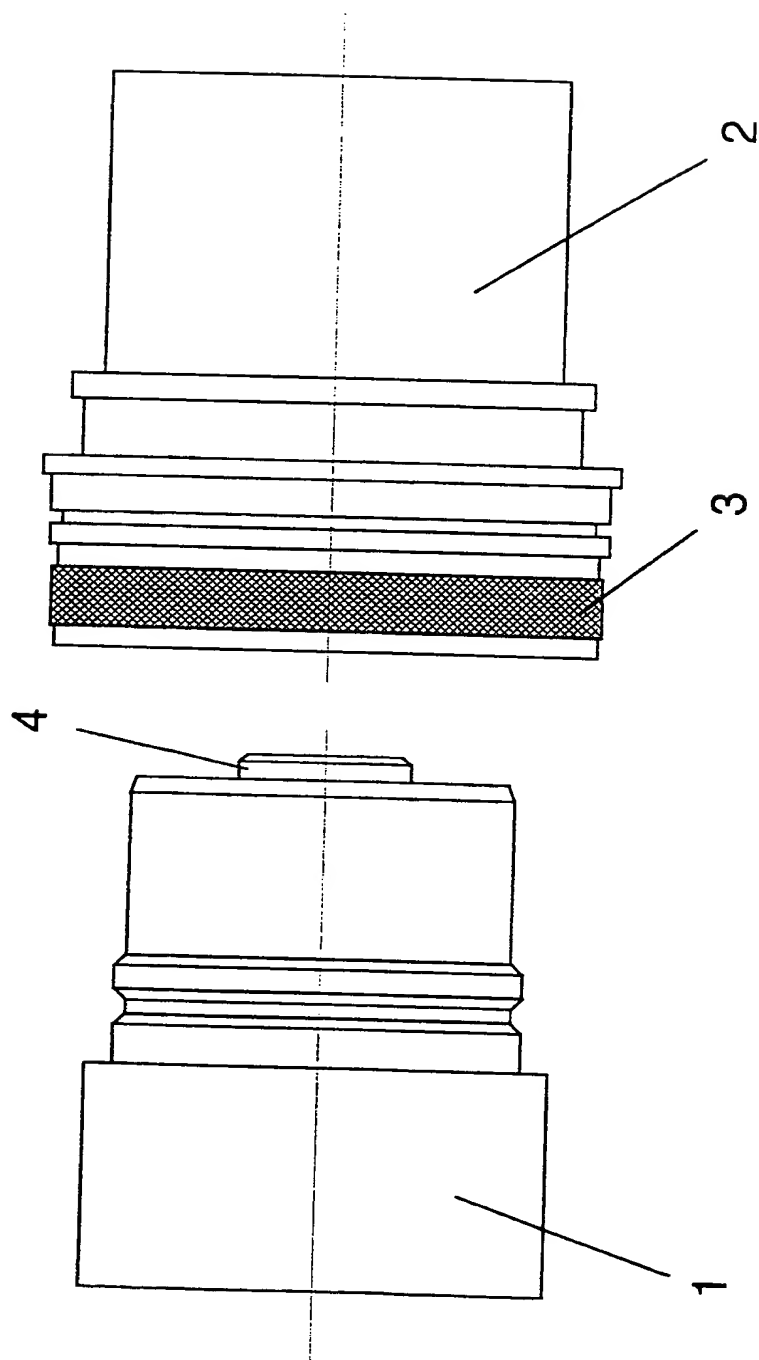


FIG 1

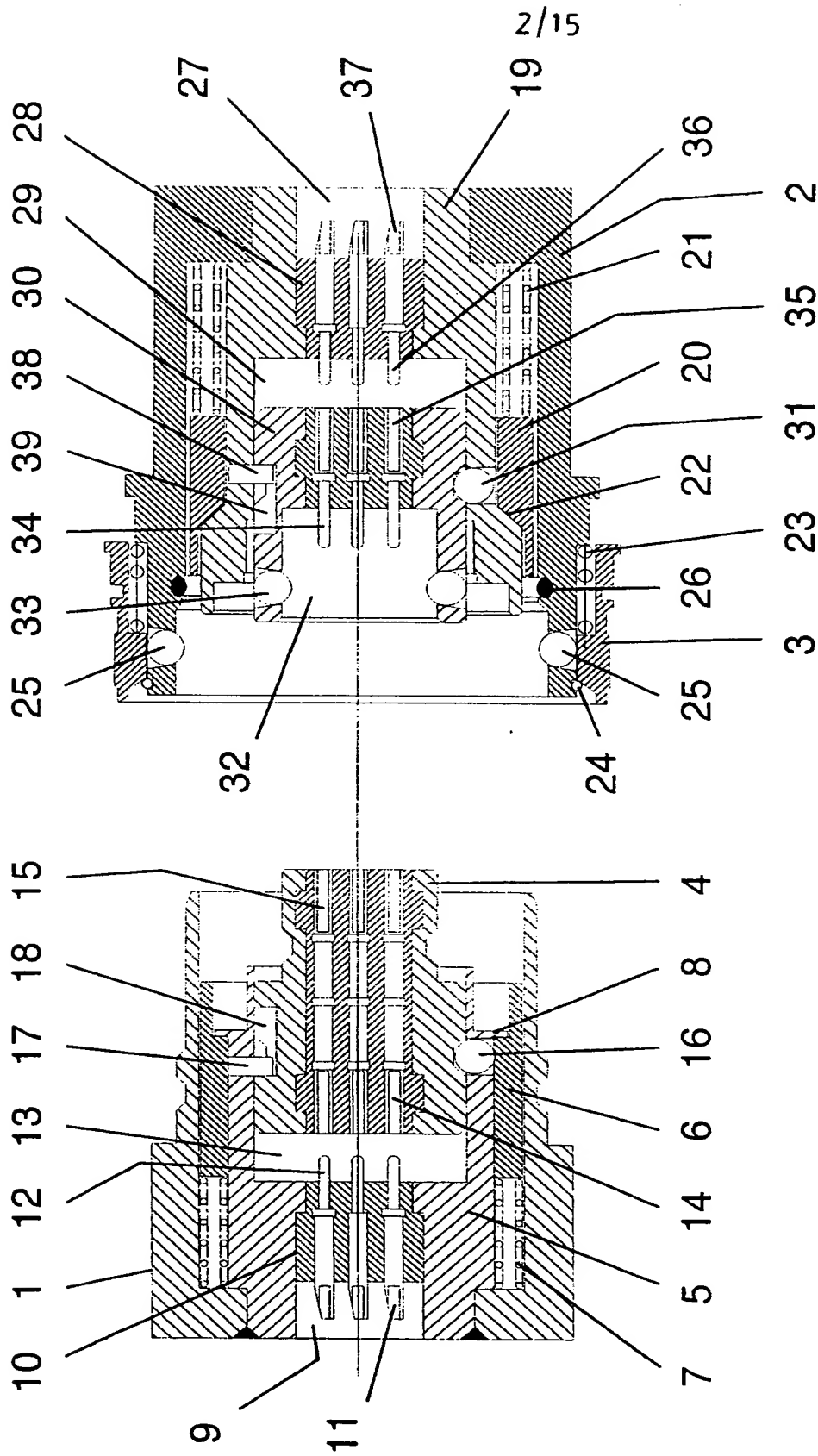


FIG 2

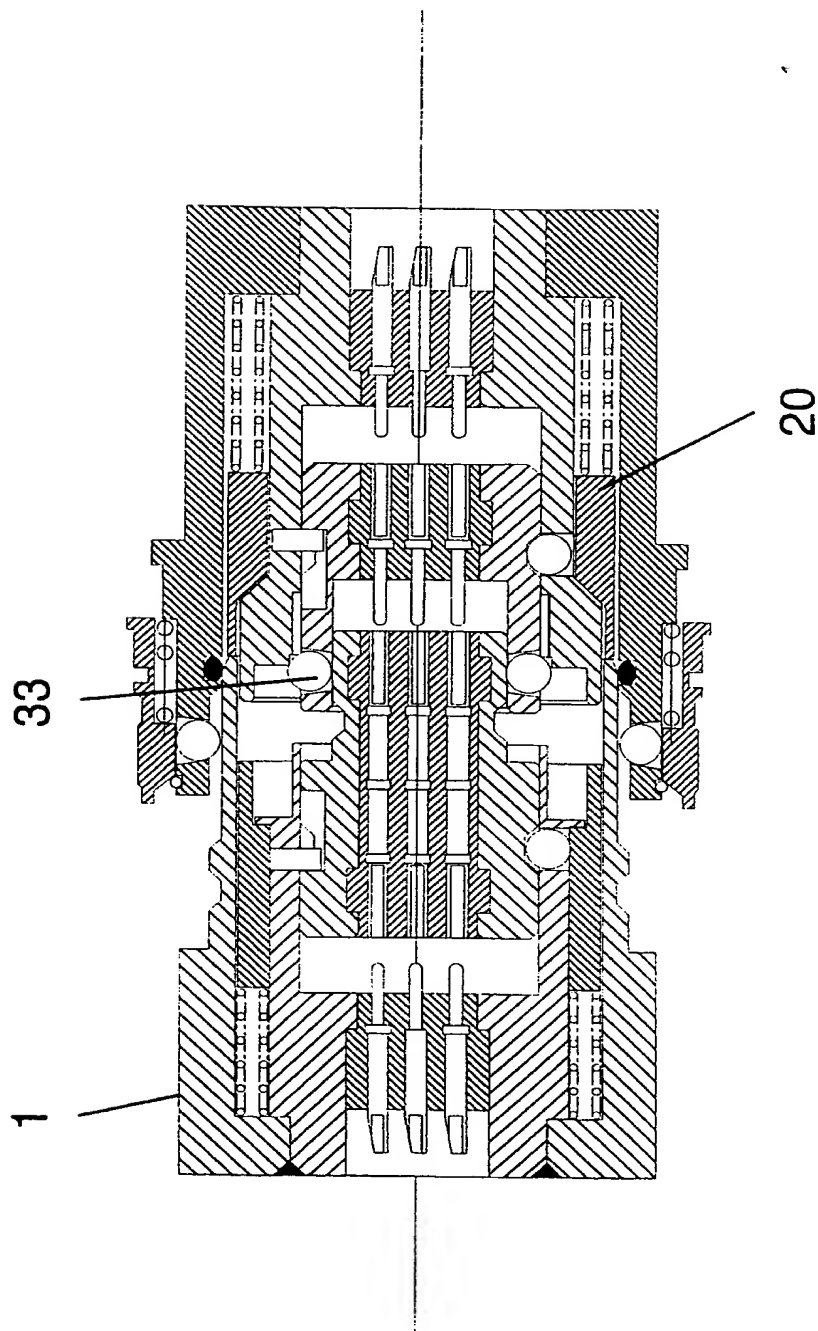


FIG 3

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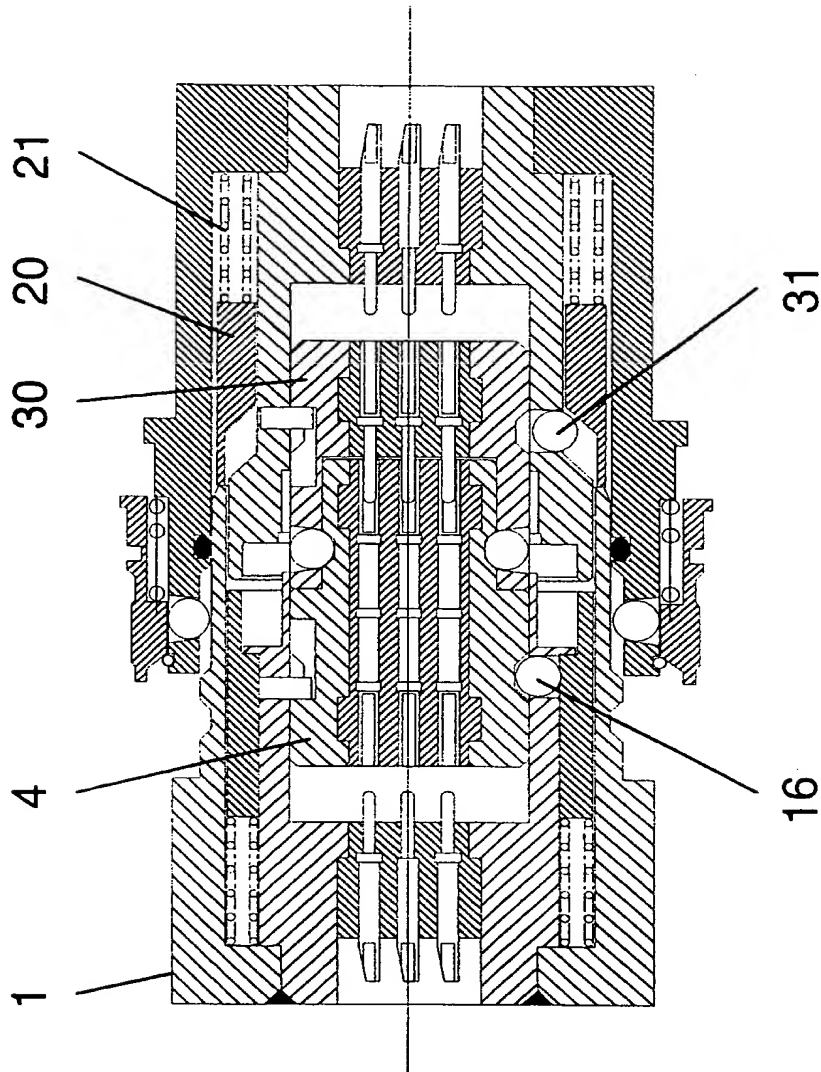


FIG 4

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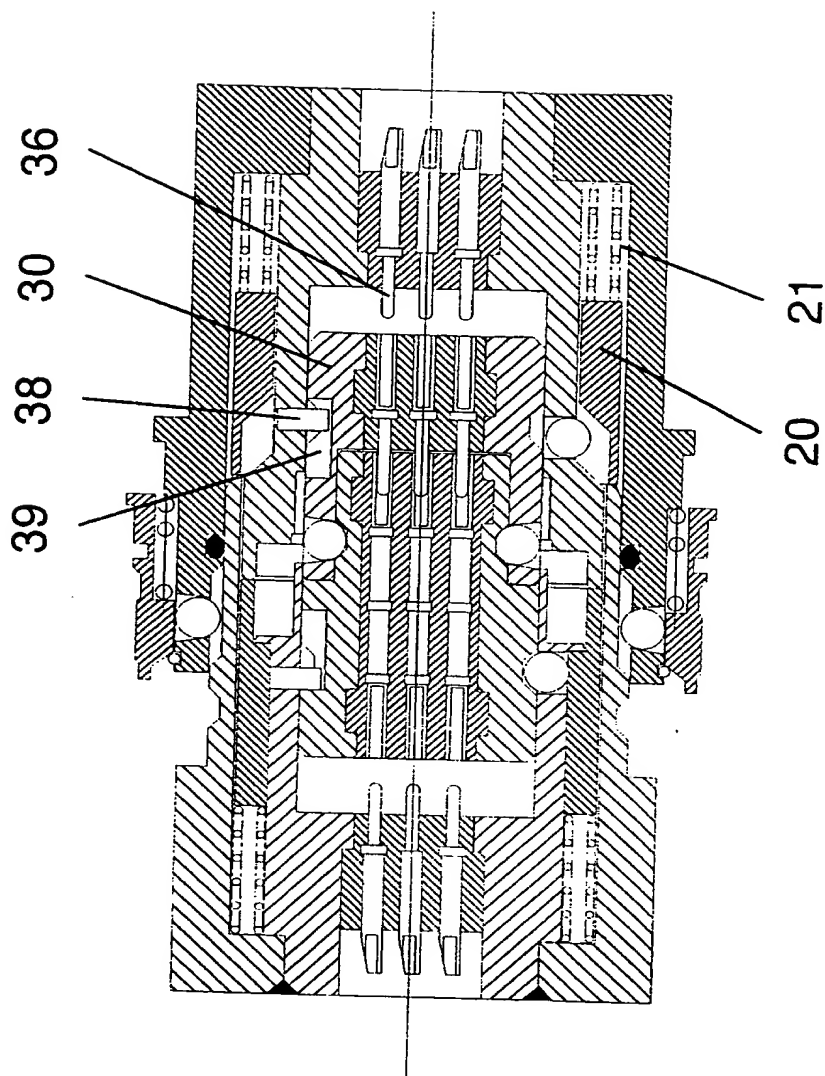


FIG 5

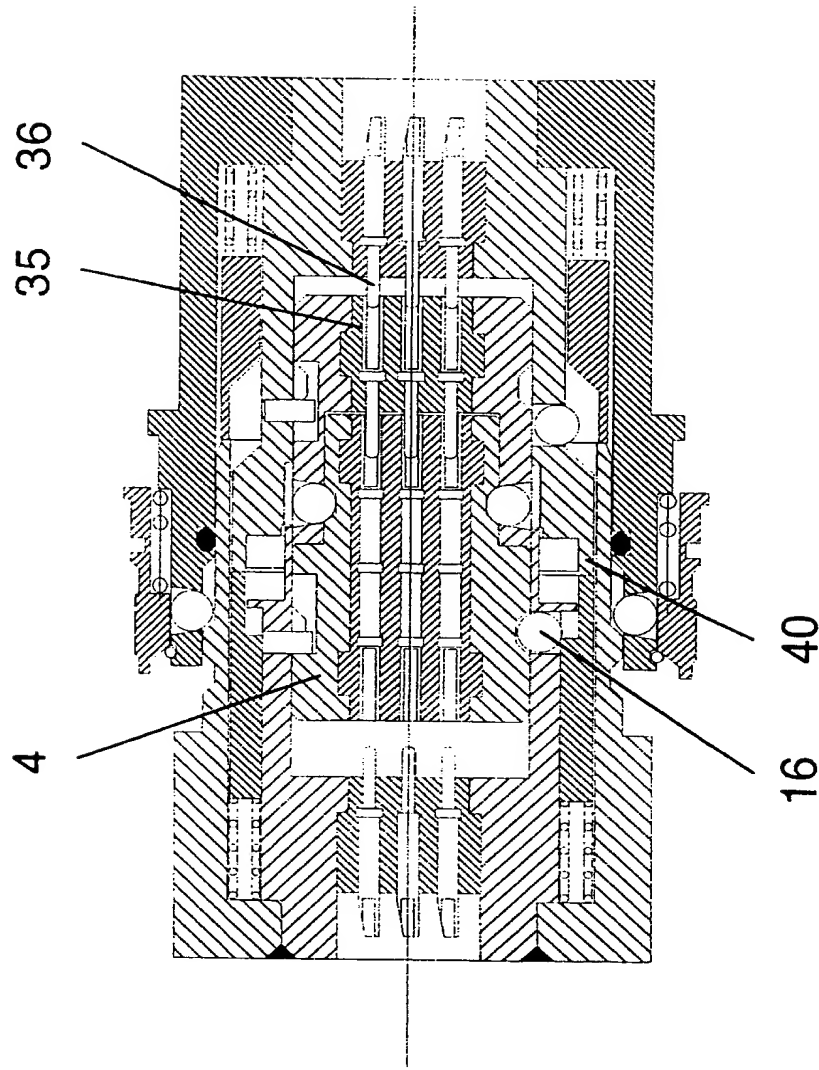


FIG 6

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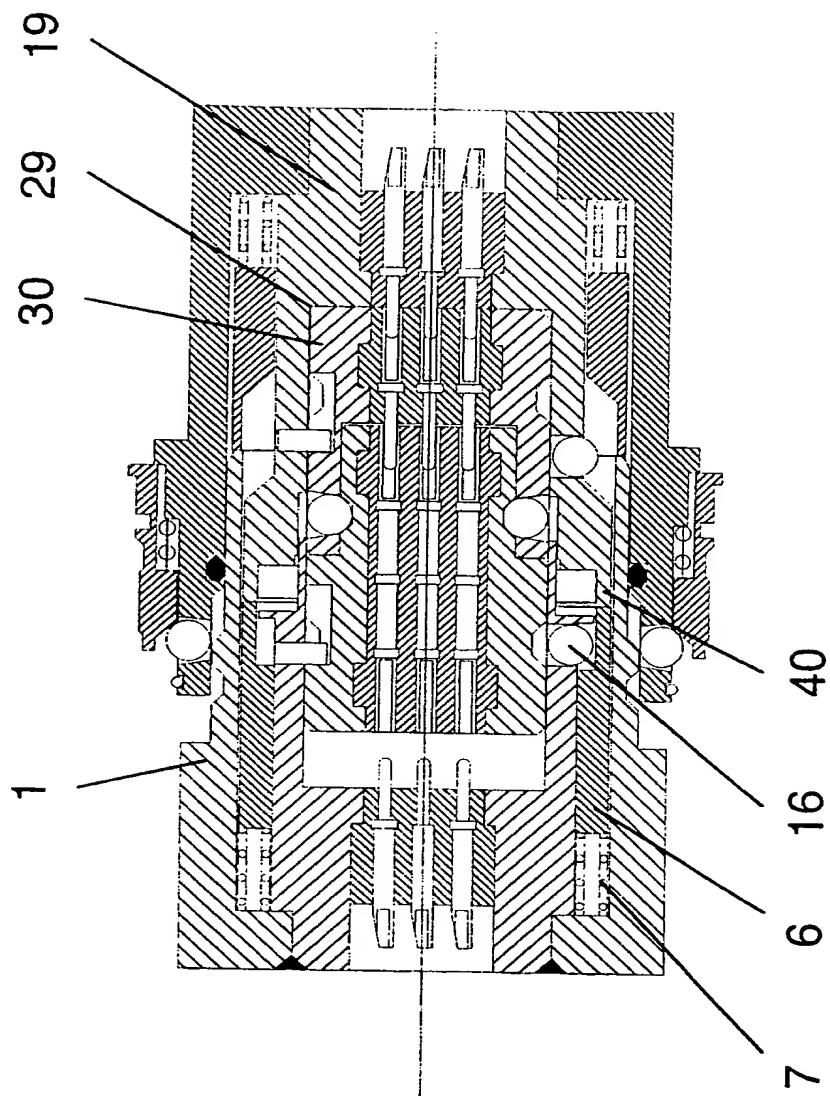


FIG 7

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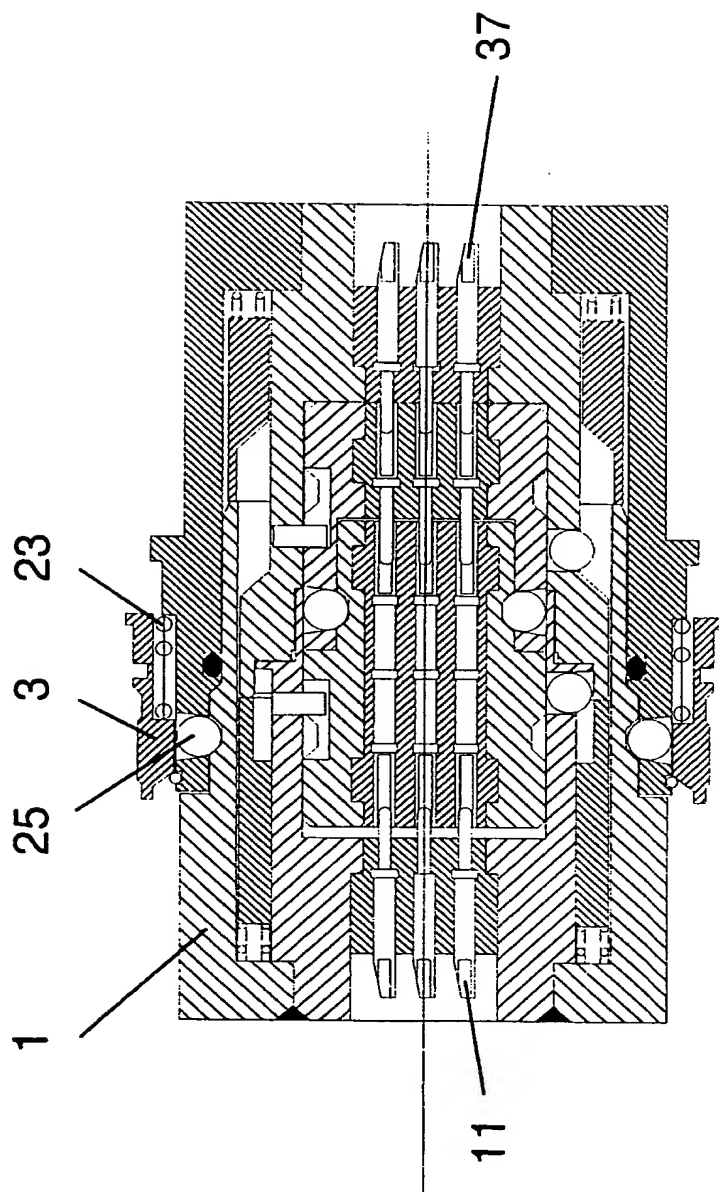


FIG 9

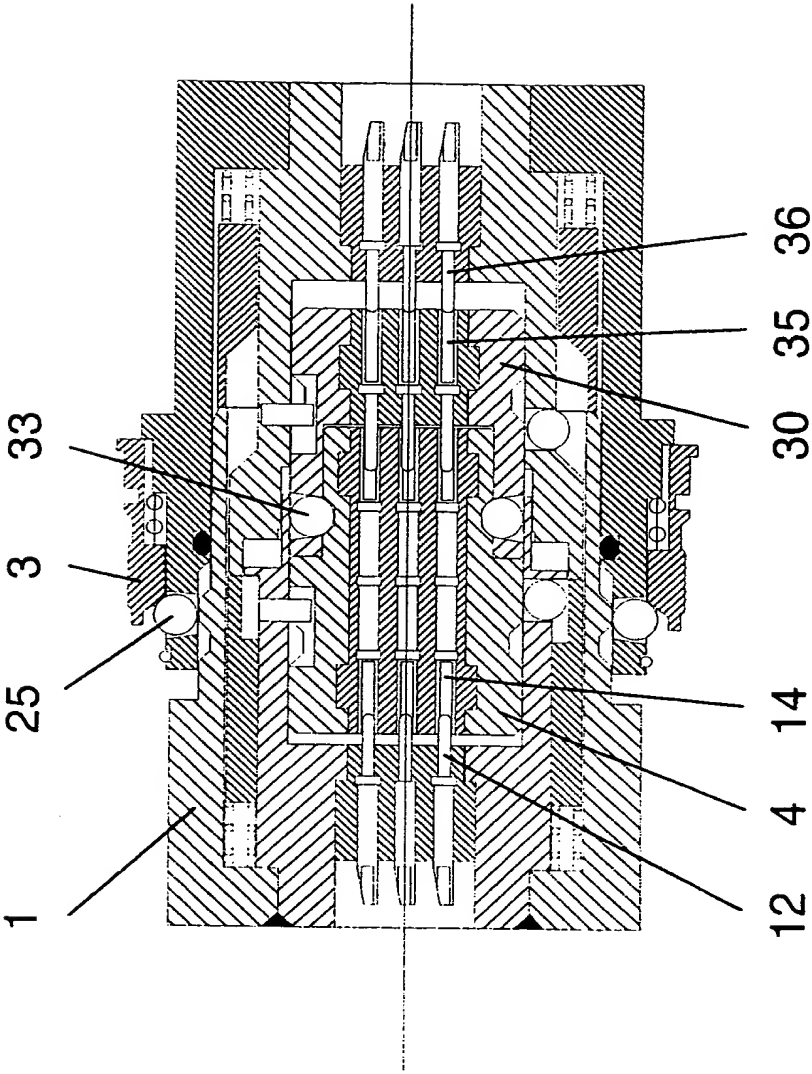


FIG 10

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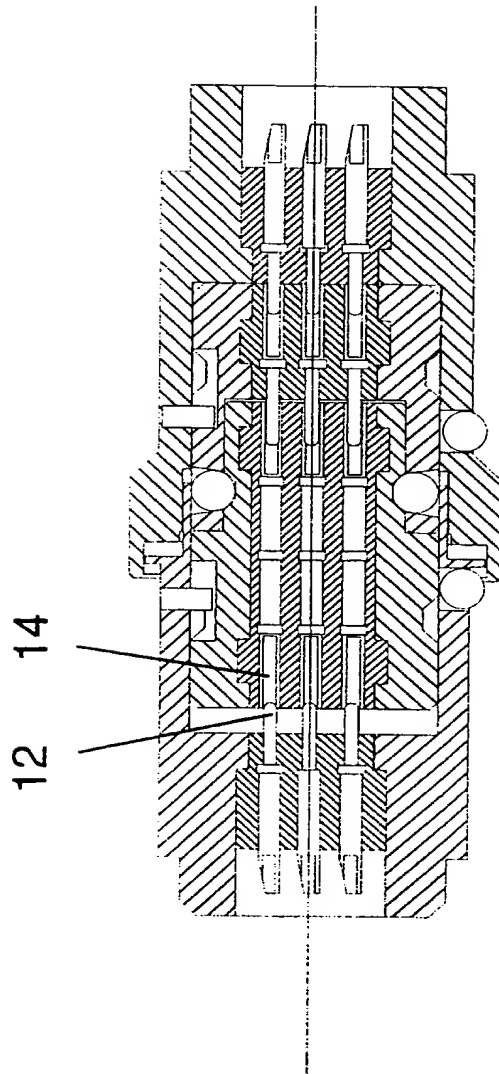


FIG 11

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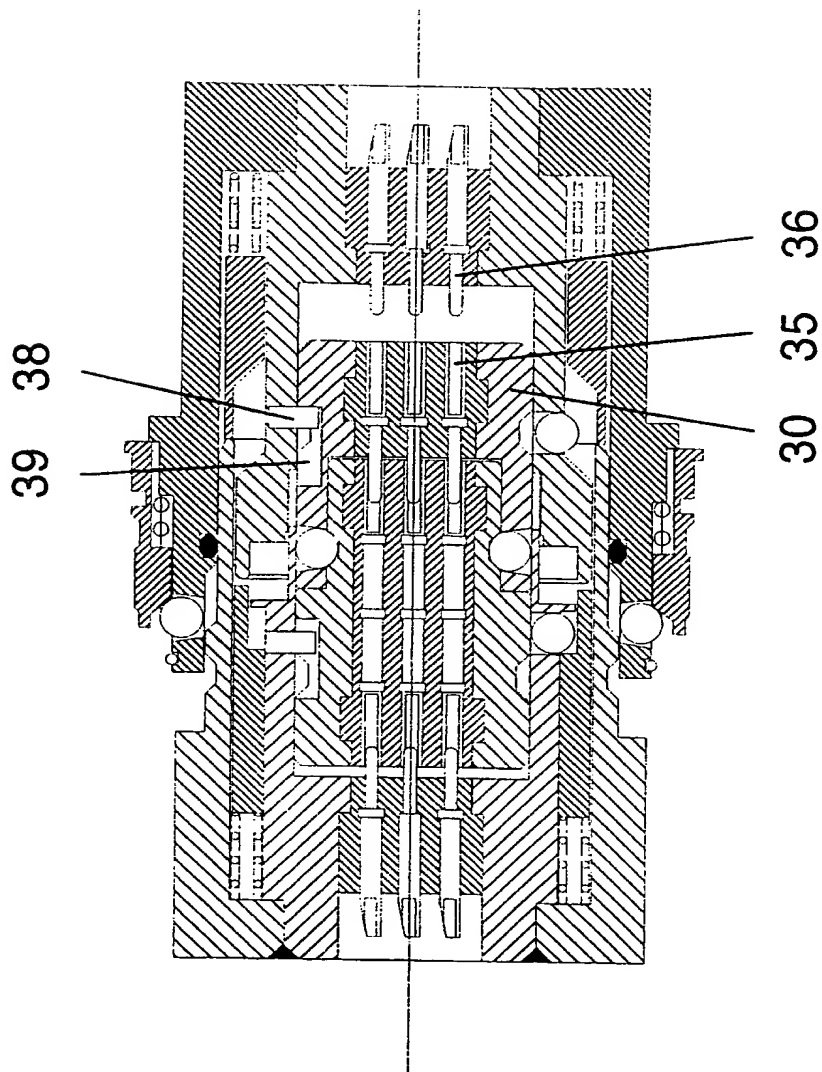


FIG 12

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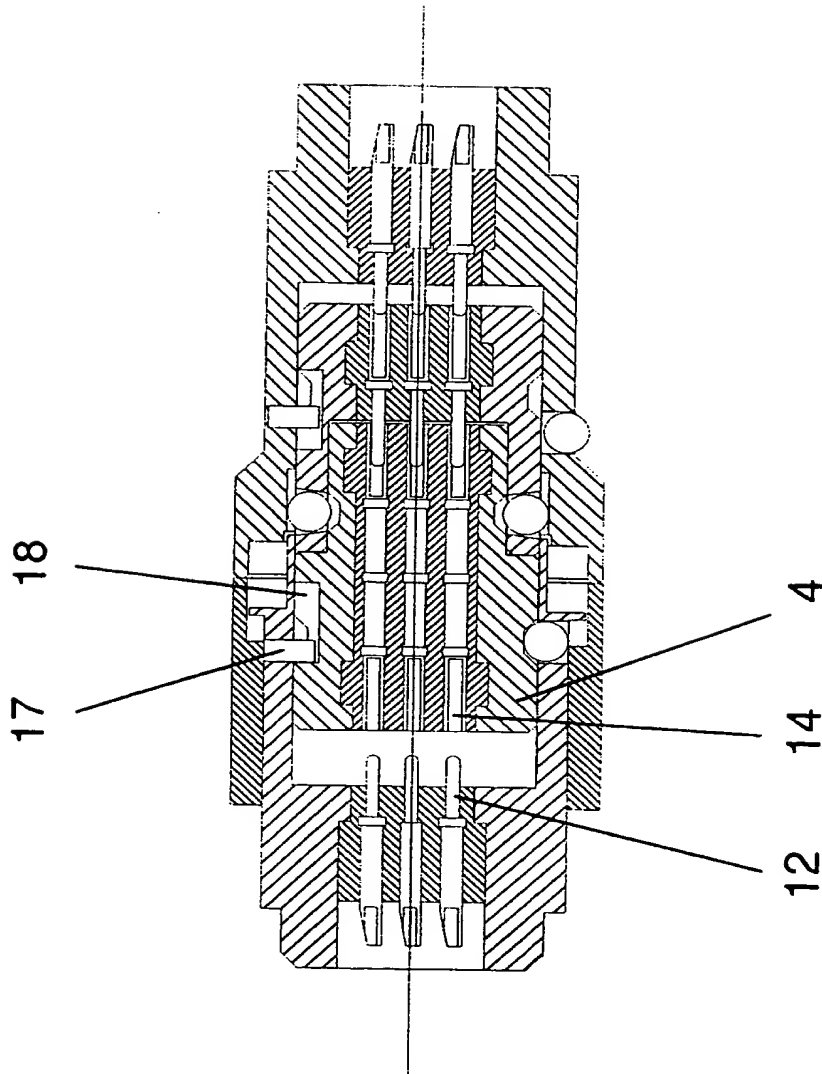
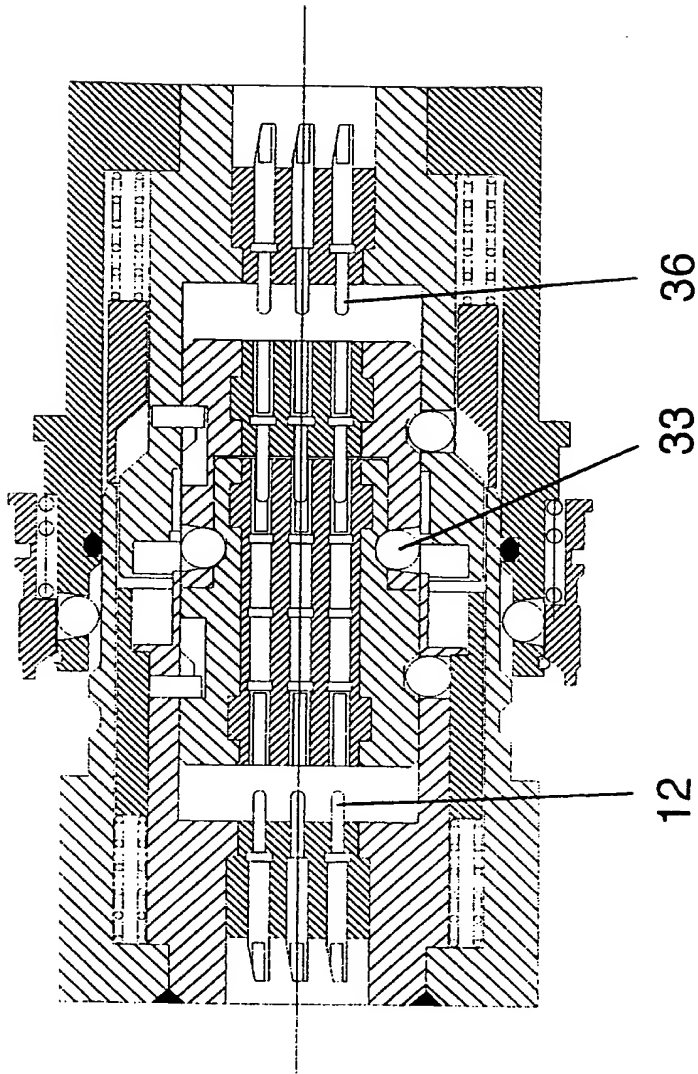


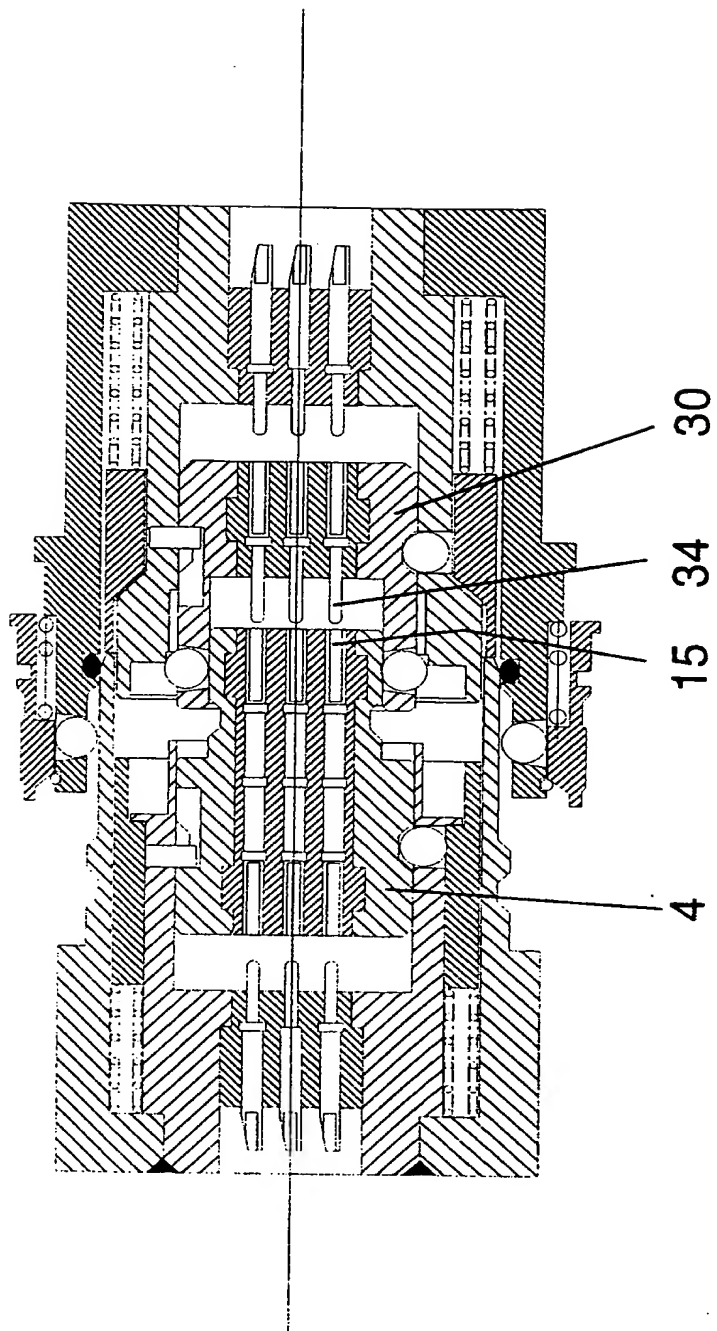
FIG 13



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INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/00312

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H01R13/703 H01R13/533 H01R13/627

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 644 871 A (S.A. FRANCELO) 22 February 1972 (1972-02-22) column 1, line 67 -column 4, line 6; figures 1,3	1,3-10
A	DE 39 30 210 A (SOURIAU) 21 March 1991 (1991-03-21) column 4, line 31 -column 5, line 44; figure 1	1-11

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

4 May 2000

Date of mailing of the international search report

15/05/2000

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/00312

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 3644871	A	22-02-1972	NONE	
DE 3930210	A	21-03-1991	FR 2651928 A	15-03-1991
			GB 2236915 A	17-04-1991
			IT 1243009 B	23-05-1994

